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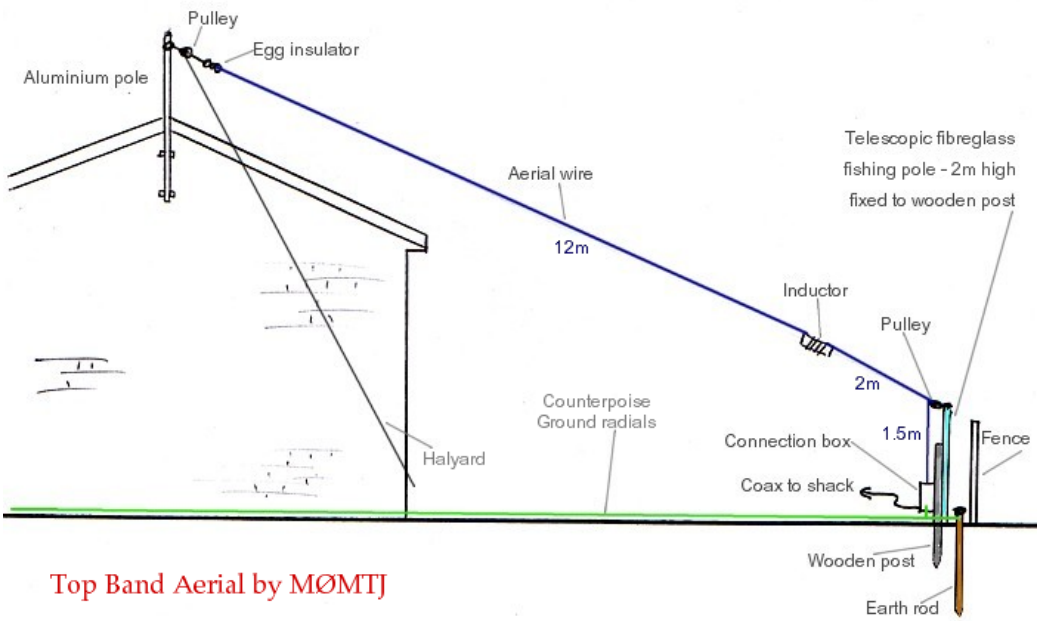
Compact Top Band Antenna - An Inverted L for stealth with low(ish) visual impact

With a small back garden there is no way that I could accommodate an aerial for the 160m band that would be anything approaching full size. A full size dipole would be about 65 metres long and would need to be mounted at a very good height to be at its most effective. A full size vertical 1/4 wave would be about 37.5 meters tall. Impossible! Bending a 1/4 wave wire into an inverted L would still result in a very long wire - say 10 metres vertically and 27.5 metres horizontally. Still too large.

Full size top band antennas are big, far too big for my small plot, so I have tried a few different shortened 160m aerials. I really would prefer to use a balanced dipole not only for the radiation efficiency, but just as importantly for the lower noise on receive - like a ground mounted vertical aerial an inverted L can be rather noisy on RX. However I have to settle for a compromise, so shown in the drawings and photographs below is my current top band aerial, along with some previous experiments and ideas further down the page.

This incarnation of my Top Band aerial takes two forms. A compact Inverted L and, in its lower position, a less conspicuous sloping wire, shown below:



General layout of Top Band Aerial with fibreglass pole retracted to a height of 2 metres
Wire lengths are approximate: Inductor 5cm dia with approx 40 turns of 0.9mm e.c.w.

G-WHIP ANTENNAS

My first experiments were with a base loaded sloper which worked ok-ish for local ground wave, but could have been better. The first weak link that I wanted to change was moving the base loading coil further up the aerial wire so that it would be positioned on the more horizontal section.

It was also very low, so could surely benefit from some additional vertical height. However I could not realistically erect another permanent pole in the garden for fear of upsetting the XYL!

Therefore I decided that I needed a design that could be semi-permanent and offer two slightly different configurations: The idea is that, as a sloping wire, the aerial can be left in place at all times for RX and still be operable on TX. Since it is essentially just a wire sloping from fence height (2m) up to the roof apex it has fairly minimal visual impact. Alternatively, when required - at night - the telescopic pole can be extended to transform the aerial into the larger Inverted L.

The Earth and Radials: The aerial is fed against ground, so the ground needs to be as good as possible. At the base of the aerial a copper earth rod is driven into the ground. Additional ground radial wires are also added to provide a counterpoise and help reduce earth loss. The more the merrier.

The Support: A 10 metre long telescopic fibreglass fishing pole is used as part of the support. A wooden post was driven into the ground, adjacent to the earth rod. The connector box is screwed on to the post and the fishing pole was fixed to the post using nylon straps.

Since the top sections of a fishing pole are too thin to support the aerial wire, the last four sections were removed, leaving the pole 6 metres in length, which is a respectable height in a small back garden, though being even taller would be better.

A small lightweight pulley is fixed to the top of the fibreglass pole using two nylon ties - as seen in the photograph. As a sloping wire, the fishing pole is collapsed to 2m in height while being extended to 6 metres when being used as the 'full' Inverted L. The pole is quite flexible and so will tend to bend quite noticeably when 6 metres long with the wire attached to the top. This could be remedied by adding a back guy rope of required.

The far end of the aerial wire is tied to a egg type insulator and nylon halyard which is suspended through a pulley on a pole attached near the apex of the roof. The nylon halyard is tied off on a cleat hook near ground level to enable easy raising and lowering of the aerial wire.

The Wire: Aerial wire is PVC covered stranded wire of about 16/18 swg http://www.whwestlake.co.uk. The wires were cut for the maximum length that could be fitted into the available space - so as much wire was in the air as possible. This was about 3.5 metres from the feed point to inductor and around 12 to 13 metres from the inductor to the far end.

(If you make one of these get the vertical portion as high as possible and the horizontal section as long as possible and reduce the coil's inductance accordingly).

The Inductor and Resonance:

The resonance of the aerial system was adjusted not by altering the length of the wires, but by changing the inductance of the loading coil.

I had some 0.9mm (20 s.w.g.) enamelled copper wire on a reel, so I used that to wind the coil. The coil former is 5cm in diameter and about 15 cm long, cut from an empty tube of silicone bath sealant (the 'gun' type). Two holes are drilled in the former for the fixing bolts and wing nuts that secure the aerial and coil wires.

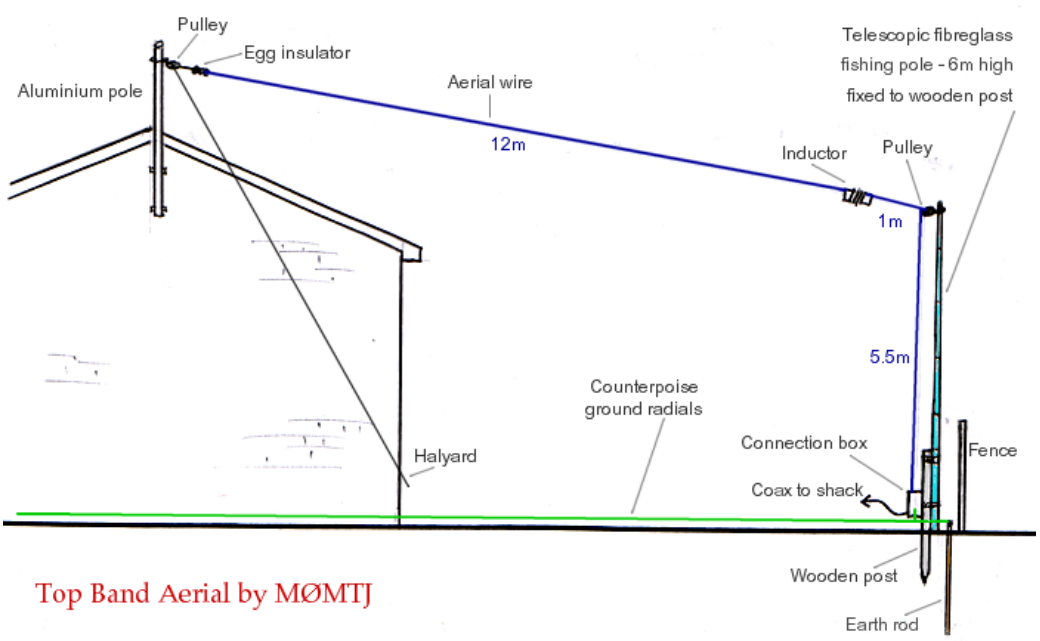
I used an MFJ antenna analyzer to check resonance and adjust the number of turns. Initially the coil was wound with 60 turns, but the resonance was well below 1800 kHz. Turns were gradually removed until resonance was around 1940 kHz, leaving 39 turns on the coil. (Thicker e.c.wire might have been better, I would have preferred to use something like 18.swg 1.2mm diameter and this may possibly get changed in the future)

Enamelled copper wire:
http://www.esr.co.uk/electronics/cable-copper.htm

When the adjustments were finished the aerial wires and coil wires are terminated with lugs and fixed in place with the bolts and wing nuts. The winding was also covered in duck tape. All exposed connections should be suitably protected against the weather for a permanent installation.

When setting up any aerial an antenna analyzer is extremely useful - allowing all the measurements to be done in the garden or back yard thereby simplifying and speeding up the process considerably. These simple

measurements can be made using the transceiver and VSWR meter, though that is obviously less convenient and will involve transmitting regular short burst of carrier, so it's very important to ensure that the power used is the absolute minimum and that the frequency being used is clear.



General layout of Top Band Aerial with a fibreglass pole extended to a height of 6 metres
Wire lengths are approximate: Inductor 5cm dia with approx 39 turns of 0.9mm e.c.w.

To transform the aerial to the Inverted L format (shown in the above diagram) I envisaged that changing the first length of wire, from a 3.5 metre length to 6.5 metre length, and the inductor would be necessary. I had assumed that a coil with less inductance (fewer turns) would be required due to the longer length of aerial wire used in the Inverted L arrangement.

I was, however, proved wrong. On first attempt I left the original coil in place, just adding the longer wire section (from connection box to coil) and raising the pole to its full 6 metres. The point of resonance was only about 20 kHz away from where it was as a sloper.

This, I think, can be explained by the fact that in the sloper configuration, the wire is close to the ground, other objects and vegetation which will in effect add loading to the aerial, Consequently a loading coil with less inductance than might otherwise be expected is required. So, by happy coincidence, the same coil is also suitable for the longer wire that is at a greater height (and therefore is influenced less by ground loading).

This, quite by chance, made the swap from Sloper to Inverted L a little easier since there was no need to wind a second coil - the change being made by merely adding the longer first wire section and pushing up the pole to its full 6 metre height.

If there are no concerns or objections to installing a tall pole at the bottom of the garden, then the Inverted L arrangement could be left as a permanent installation. In that case the pole need not be a fibreglass fishing pole, although it is still an attractive lightweight method, instead a couple of 3 metre long sections of treated timber could be joined together to form a 6 metre high post - the higher and longer the better though!

These links may be useful in helping to calculate loading coils:

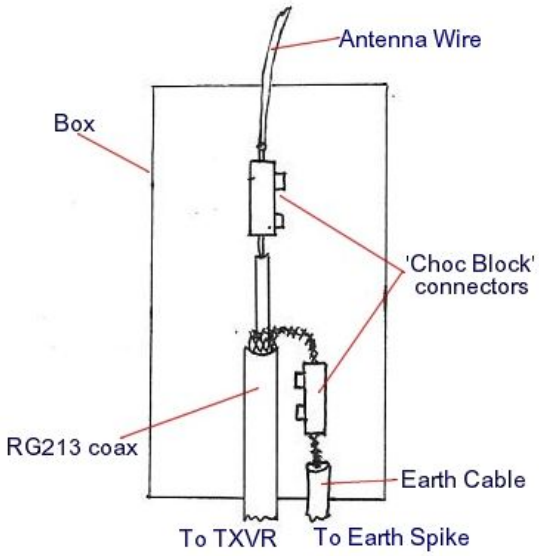
Antenna Loading Coil Calculator : http://eweb.chemeng.ed.ac.uk/jack/radio/software/loading.html

Coil winding design program : http://ecosse.org/jack/radio/software/newcoil3.html

Loaded dipole calculator by K7MEM : http://www.k7mem.com/Electronic_Notebook/antennas/shortant.html

Ring Core Calculato r: http://www.dl5swb.de/html/mini_ring_core_calculator.htm

Top Band Inverted L - photograph showing the wooden support post with telescopic pole attached with connection box, cables and earth rod. The cable entering from the left is the earthing strap which is connected to ground rods and radial wires. The coaxial feeder cable exits from the bottom right of the box and is wound around a length of white plastic pipe to form a simple RF Choke.



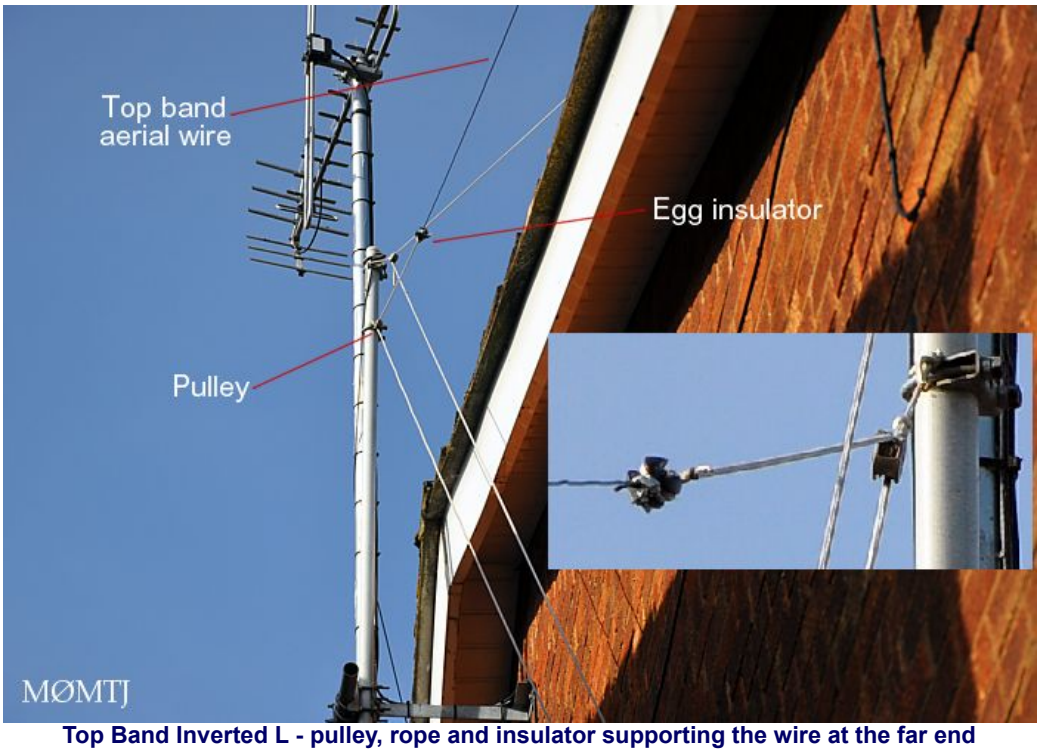
My original implementation which used 'choc block' connectors. The final design has all soldered joints with a stainless steel bolt and wing not at the top of the connecting box.

Top Band Inverted L - pulley on top of the 6m telescopic pole

Top Band Inverted L - loading inductor.

This is the unfinished coil, the connections on the left are properly finished off using lugs, but the connections on the right are unfinished to allow adjustment of the number of turns. When that is settled the final lug is soldered to the end of the enamelled copper wire and held in place with the bolt and wing nut. The coil is 39 turns of 0.9mm e.c.w., wound on a 5cm diameter former made out of an empty silicone bathroom sealant tube. (I would have preferred to use slightly thicker e.c.w. of about 18 swg 1.2mm diameter, so that may get changed in the future)

Enamelled copper wire:
http://www.sycomcomp.co.uk
http://www.esr.co.uk/electronics/cable-copper.htm



Top Band Inverted L - pulley, rope and insulator supporting the wire at the far end

Top Band Inverted L - supported by a 6m long fibrelass (roach) pole

Top Band Inverted L - looking up!

The photo exaggerates the bend a little, but it's not enough to worry about. The bend could easily be corrected by adding a back guy to pull the pole back towards the vertical position, but for this job it's fine as it is.

DOES IT WORK?

Yes! This aerial does work, I am glad to say!

It works better than my initial short sloping wire shown further down this page, which is what one would expect!

Rather than merely settling for a local ground wave signal I was very pleased to contact Top Band enthusiast Steve G7KLJ on my first attempt. Steve is 170 miles distant from me and the night time sky wave provided a pretty good result. G7KLJ gave me a 5 / 8 with my 100 watts on 1843kcs using my small aerial. I gave G7KLJ 5 / 9+10 with Steve's large doublet and 400 watts (lovely audio too Steve!).

Admittedly that's potentially a 16dB difference, which is pretty huge, but G7KLJ had the benefit of 300 more watts - that's a 6dB advantage. It also depends on how the individual S meters compare. Steve seemed to indicate that his S meter was a bit on the lazy side - 1 S Point pessimistic? But maybe my S meter similarly pessimistic?

Compared to a full size inverted L my loaded aerial is less than half the size and is obviously going to lose out, but by how much? Half the size, half the effective power - 3dB down? Probably a lot more - 6dB? There's one S point lost already (Who wants to bet that it's a lot more than that?). Since I have a ground system that is far from ideal there's another few dB's lost - another 6dB? That would be 2 S Points lost before taking into account anything else. This is all pure guesswork and speculation admittedly and probably quite groundless (almost literally in my case), and might best be described as pointless ramblings! (Where did the delete key go?) The pessimist? The realist?

The only thing proved by this single event is that my aerial radiates at least something useful - and that G7KLJ has a great station! www.g7klj.com

Droitwich

OK so it's not Droitwich, but it does work and gets me on Top Band when otherwise there would be no chance.

I am happy - but as with anything improvements can always be made. The aerial could be taller perhaps, though I cannot make it any longer. The earth system could be far far better, though I would struggle to accommodate any improvements at the present QTH. I could use better coaxial cable and also (importantly) attempt to lower the received noise by experimenting with chokes or burying the feeder to reduce common mode currents.

Plenty to think about and plenty to play with!

Important notes on effective Grounding by Jim K8OZ

Mike - I was reading about your work on the 160 meter Inverted L, and it makes me want to go out and build some more antennas! Congratulations. Your story is fascinating, and very well documented.

The only thing I can offer as a suggestion is to get as much radial wire along the edge of your property as possible (assuming your XYL will not allow you to bury radial wire all over your yard). Even if you can only run multiple wires 1/8th of a meter apart from each other, and parallel to each other, your losses will be reduced. The ground losses have quite an impact on your transmitted signal, so any wire you can "hide" along the edge of your property will help improve your signal strength - little, by little...! { It may also affect your resonant frequency slightly, but that's easy to deal with by adjusting with an antenna tuner or slightly changing the loading coil. }

Good luck OM, and keep up the refinements on your antenna system. You're doing great! 73,

Jim, K8OZ
Albuquerque, NM

Top Band Antenna by Mark, G0MGX and Vince G0ORC

Mike, I've been reading with interest your musings on top band antennas and have tried to build a replica of yours today with a fellow ham G0ORC. Thanks very much for the information and the link. You can see the results of my attempts here:

Construction: http://g0mgx.blogspot.co.uk/2012/08/top-band-what-happens-there-then.html

It Works!: http://g0mgx.blogspot.co.uk/2012/08/well-this-top-band-twig-does-it-work.html

Mark. G0MGX

Mike,

I know you have been in contact with my good friend Mark G0MGX but I felt I needed to say thanks and acknowledge your work on a 160m sloper.

It works very well here and, thanks to Mark who built several inductors until one gave us an SWR of 1.1 on the CW end of the band and also braised several copper rods together for form a reasonable earth under a large pine tree. He has passed on to me details of the website of K7MEM which may well inspire me to try a sloper for 80m as well.

I've always wanted a top band antenna but felt that I didn't have the room - but thanks to your idea and Mark's enthusiasm for the project I now have what I wanted - I'm being heard (and can hear) into European Russia with it so it certainly works!

Thanks again - I enjoyed your website very much. (Just heard A65BP as well!)

73, Vince G0ORC http://www.qrz.com/db/G0ORC

Further Developments of this antenna...

Another Top Band Aerial by MØMTJ

After reading the article "Top Band in a Small Garden" in the August 2012 edition of Practical Wireless Magazine ('PW'), I investigated further development of my Top Band Sloper / Inverted L Antenna (shown above).

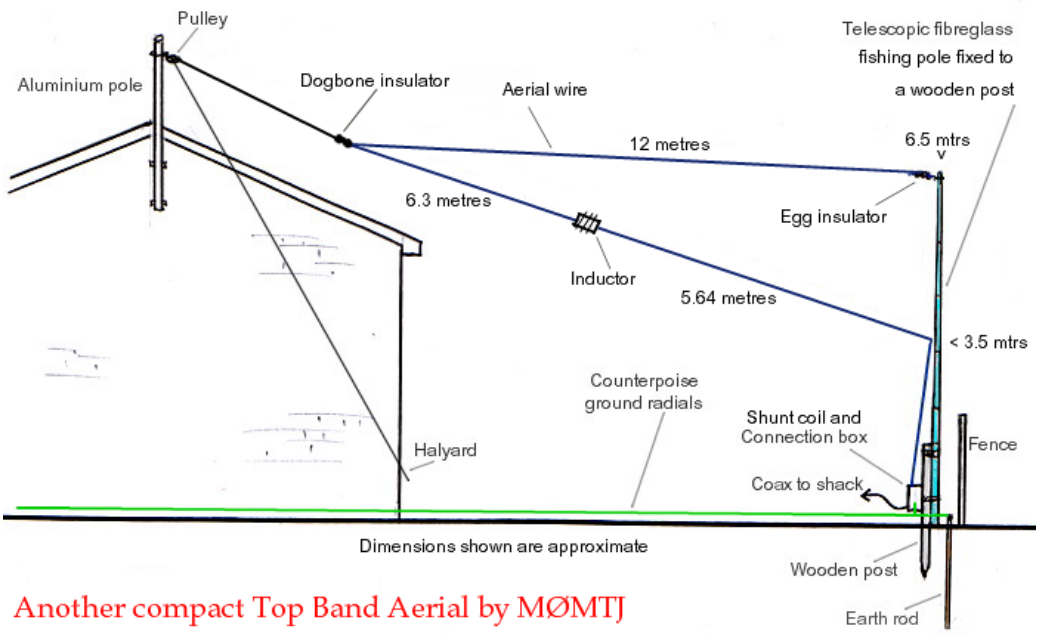
The article by Stuart Craigen G4GTX described a compact wire antenna for top band that could be accommodated in small gardens. The antenna is shunt fed at the base, the coax being connected across a 7 turn coil (wound on an off-cut of an empty silicone sealant cartridge), with the braid connected to the earth stake and radial ground wires. The centre conductor is connected to the aerial wire.

I could not quite accommodate the shape that Stuart suggested for the aerial wire, but it is very similar: For my version the feed point is at the bottom of the garden near the fence immediately adjacent the earth stake. The first section of aerial is about 9.14 metres long - the wire rises 3.5 metres vertically up the 6.5 metre tall telescopic pole, at the 3.5 metre point the wire is held in place on the mast by a small bungee and then folds over almost horizontally

and runs for a further 5.64 metres where it connects to the loading inductor.

The inductor consists of 36 turns of 18 swg (1.2mm diameter) enamelled copper wire on a 50mm diameter, lightweight plastic former (again made from an off-cut of an empty silicone sealant cartridge). After the inductor there is a further 6 metres (approx) of wire rising to a dog-bone insulator, fixed to the end of a length of para cord that runs up to the pulley shown in a previous photograph. From the dog-bone insulator the aerial wire runs back, in the opposite direction, for about 12 metres, returning to the top of the 6.5 metre tall mast at the bottom of the garden, tied off to an egg insulator which is itself fixed to the top of the mast by a very short length of para-cord fixed to the mast by a thick nylon cable tie.

If the wire dimensions are changed, the number of turns on the inductor will have to be changed accordingly. Similarly my antenna is located quite near the 80m/40m Inverted L and the interaction of the antenna affects the tuning and hence the number of turns required on the loading coil.



Another Top Band Aerial (drawing not to scale)
The inductor is 36 turns of 1.2mm diameter (18 swg) enamelled copper wire on a 2 inch former

With that arrangement there is about 27 metres of wire in the air. The point of resonance is 1900 kHz, but this can be adjusted by altering the number of turns on the inductor. As expected bandwidth is quite narrow. As with any antenna fed against ground the earthing needs to as extensive as possible - as noted previously, above. I suspect that it may be better that the top wire should be horizontal, or sloping slightly upwards, however with the available space and materials available the best that I could achieve had the top wire sloping slightly downwards to the post. Lowering the position of the dog-bone insulator or using a taller post could overcome this.

Photograph of the feed-point of the compact, folded, Top Band antenna showing the 7 turn shunt fed coil in the weatherproof housing. Nuts and bolts are stainless steel.

First Test: A brief on air test on 8th September 2012 between 2100 and 2130 UTC on 1.933 MHz brought in two prizes: Peter EI7JM near Malin Head and Tony M3LTD in Naseby, Leicestershire. EI7JM was a true 5/9 to me and he gave me a report of a true 5/9. M3LTD was 5/7. Many thanks to both stations for the useful contacts.

For different sized gardens the best idea might be to get as much aerial wire into the air and then make adjustments to the point of resonance by simply adjusting the number of turns on the inductor.

Practical Wireless Magazine
Obtain the article "Top Band in a Small Garden" by Stuart Craigen G4GTX from Practical Wireless Back Issues department

Stuart Craigen G4GTX comments:

Hi Mike, I have just been looking at your fascinating antenna page on top band antennas! Glad to see that you had a

go at building my shunt fed wire vertical that I did for Practical Wireless! I found it tremendous. A few weeks ago I was talking to G3YFN in Newcastle at about 4pm when I was called by G4BIM in the Isle of Wight! I also got a QSL 5/9 from Luxembourg!. Have fun.with it!

Thanks for the nice comments about my shunt fed 160m aerial. I enclose some QSL cards which you might find interesting to look at! Note the times of the QSO's and the reports! At night I have been told that I sound like the BBC from some European stations!!

Note G4BIM Isle of Wight 5/7 from Sunderland at 4.30 pm and Aberdeen at night. It certainly works for me. I think that the shunt feeding is the answer as it taps into the aerial at the 50 ohm point. Putting the loading coil away from the base should increase efficiency hence approx midway. A chap near Newcastle built one of these a few years ago and his groundwave signal was 5/9+20 here in Sunderland 12 miles away!!!
73
Stuart G4GTX

More ideas....

Adding Top Band to the 40m / 80m Inverted L antenna using a switchable loading coil:

Due to an aborted house move in 2010 I had removed all the antennas. While re-establishing the aerials in 2011, and considering space limitations, I decided to experiment with adding a loading coil to the 40m / 80m Inverted L aerial. The loading coil has a link wire to short it out of circuit when using the aerial for 80 metres and 40 metres. The link wire is removed when Top Band is required. The coil consists of approximately 37 turns wound on a piece of 68mm (2.8 inch approx) diameter PVC pipe:

Work In Progress! - Adding 160 metre loading coil to the 80m / 40m Inverted L Aerial.
The loading coil has a link wire to short it out of circuit when using the aerial for 80 metres and 40 metres.
The link wire is removed when Top Band is required.
The coil consists of approximately 37 turns wound on a piece of 68mm (2.7 inch approx) diameter PVC pipe.

More about the 80 / 40 metre Inverted L Aerial on Antennas Page 1 >

Simple Vertical Top Band Aerial Using A Fibreglass Telescopic Fishing Pole (Roach Pole)?

If there really is no space to accommodate a top band dipole, inverted V or even the inverted L above, then another option could be a simple vertical. Again based on a 10 metre long fibreglass roach pole, this could be installed as a

permanent aerial, or only deployed as and when required on a temporary and stealthy basis.

The 10 metre long fishing pole would be erected by standing it on the ground, using three or four nylon guy ropes as support, or tying it to a wooden ground stake driven into the ground. The vertical radiator would consist of about 9.5 metres of PVC covered wire fixed at the top of the pole and with a loading coil at the centre. As with the design above, the loading coil could be wound on a 5 cm diameter using 1.2 mm diameter enamelled copper wire. To make the former as light weight as possible, once again, the tube from an empty bathroom sealant (or silicone sealer etc) gun could be used. They are, conveniently, 50mm in diameter.

I have not experimented with the number of turns required for the centre loading coil, but from experience with the above aerial, the figure may lie somewhere between 50 and 100 turns.

The aerial would be fed with coaxial cable and would need a good earth rod at its base and a good number of ground radials, as along as possible.

Previous Top Band Aerial Experiments:

Top Band Inverted V

This is a considerably shortened dipole for 160 metres, using loading coils to reduce the length of each leg to about 7.5 metres length. Each coil is wound on a 5 cm diameter former and consists of approximately 120 turns of 1.2mm diameter enamelled copper wire. The dipole was arranged in an inverted V configuration.

Being as a dipole is a balanced aerial, it was fed at its centre using balanced twin feeder for lowest loss and, being balanced, lowest noise.

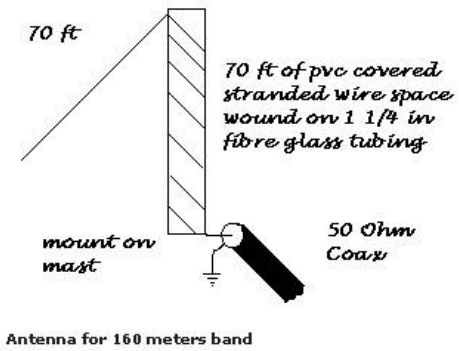
In this configuration it was very quiet, but did also appear to receive very well. At my QTH the noise on top band generally ranges from S7 to S9, on this inverted V the noise was S4 to S6. However it did not transmit well at all - I believe this to be not only because the dipole is very short (only 15m) but because the angle at which the wires at the top of the V was far too acute - only about 45 degrees. The angle at the top of the V really should be over well 90 degrees - maybe something like 110 degrees would be best. Clearly this seems to be a problem.

I had not got the space to separate the wires any further, but it was an interesting experiment that appeared to demonstrate that a balanced dipole fed with balanced twin feeder could help reduce noise. If more space was available this is an antenna that I would wish to pursue further.

Top Band Shortened (loaded) Inverted V

Short Base Loaded Sloper - a first attempt at a top band antenna

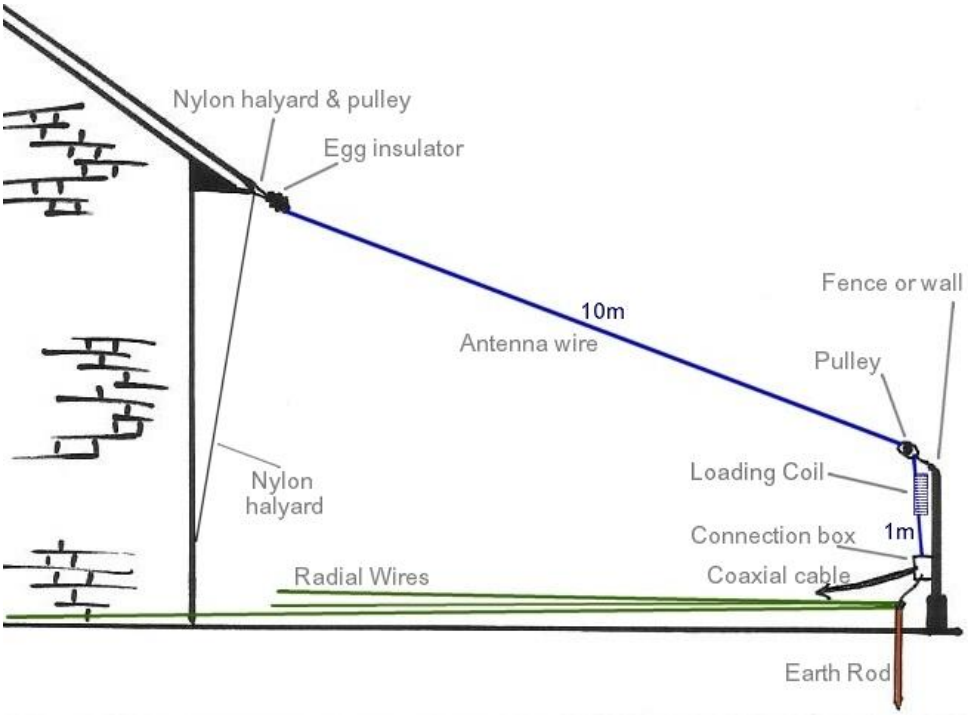
160m metres is probably the noisiest band, but I wanted to give it a go anyway even though space at my QTH is at a premium and fitting in a suitable antenna is quite challenging. The most promising candidate that I initially found, apart from small commercially available antennas, was the "Practical Antenna For 160 metres" described by Frank G3YCC and featured on the website of IW5EDI and linked to on the pages of www.dxzone.com


70 ft
70 ft of pvc covered stranded wire space wound on 1 1/4 in fibre glass tubing
mount on mast
50 Ohm Coax
Antenna for 160 meters band

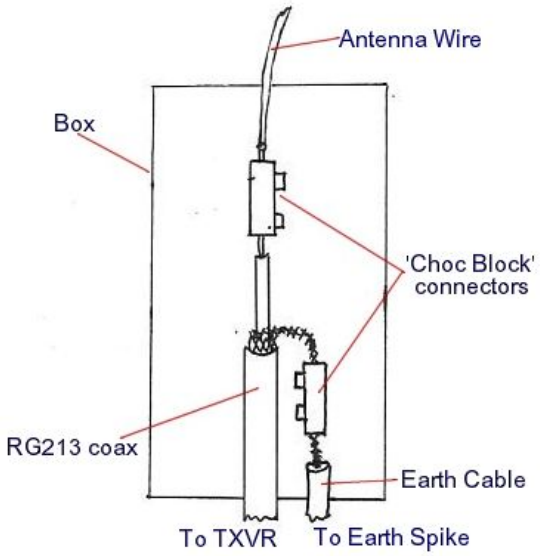
G3YCC Top Band Antenna

This Top Band antenna consists of 140 feet of wire, 70 feet space wound around a non-conductive (fibreglass) pole or tube about 6 feet long, with remainder forming a sloping wire falling back to near ground level. The antenna is UN-Balanced and is therefore fed with unbalanced coaxial cable, with the braid connected to a ground stake at the base of the aerial.

The above design is intended to have the coil section mounted on top of a mast or pole with the wire running downwards. I could not accommodate that arrangement, so I adapted the design to produce the antenna shown below:



The drawing above shows the loaded Top-Band Antenna - a first attempt at an aerial for 160m - consisting of the radiating top wire, a base loading coil, earth stake and additional earth radials that act as a counterpoise: The top wire is about 10 metres long and slopes down to the loading coil which consists of 64 turns of the aerial cable wound around a 4" diameter PVC pipe and then falls vertically for about 1 metre where it enters the connection box. The halyard arrangement allows the antenna wire to be quickly dropped for adjustment and then raised back into position. There is an earth rod at the base of the antenna connected to several ground radials and a second earth rod a few metres away.After performing some tests I find that it does work reasonably well for local contacts ground wave contacts around the town, but it could be better and is certainly very disappointing for longer distance work.



Above: The Connection Box

Read more developments here>

Efficiency

The aerial shown above is obviously very much shortened and therefore is very inefficient when compared to a full size resonant quater wave aerial. A shortened aerial still needs to make best use of the space - so the antenna wire

needs to be as long as possible. Resonance is adjusted by varying the inductance of the loading coil. Also it is necessary to use the largest earth system as is practicable to obtain the best possible efficiency.

Performance

In my configuration described above it is admittedly a very low efficiency antenna - but at least it gets one on Top Band! It's ok for local working around a town or a city, but it's certainly not a DX aerial by any stretch of the imagination. I could hear many stations 100 to 200 miles away, but they could not read my signals. For local ground wave work it was adequate.

I suspect that if the original design by G3YCC was employed, i.e. the coil mounted at the top of a pole and the loading wire running down, that it may work rather better than my implementation. The problem that my implementation has is that the loading coil is at the bottom of the aerial, near the ground. Better efficiency may be acheived with centre loading. The longer the radiating wire the better too.

More Details

The antenna was fed by coaxial cable from the shack in the bedroom at the front of the house to the feed point at the base of the fence at the bottom of the back garden. The coaxial cable enters a small plastic box, screwed to the fence post, where it is terminated: The outer conductor of the coax is connected to the earth cable with a 'chock block' connecter, the earth cable going to a four foot long earth rod hammered into the ground near by. The centre conductor of the coax is connected to the antenna cable also using a 'choc block' connector.

The antenna wire runs vertically up the fence for about 1 metre to the loading coil which consists of 64 turns of the antenna wire wound around a piece of 4 inch diameter PVC pipe. About 32 turns a close wound and the other 32 turns space wound; The inductance, and therefore the point of resonance could be easily adjusted by altering the spacing of the windings. Once set at the required point of resonance the windings can be held in place with duck tape.

The antenna wire exits the coil at the top and passes through a pully secured to the top of the fence and then slopes upwards for about 10 metres to the fixing point at a convenient point on the house, in this case the eaves. The end of the wire is tied off to a plastic 'egg insulator'. The egg insulator is tied to a nylon halyard wich passes through a second pully at the fixing point. This allows the antenna wire to be quickly dropped for adjustment and then raised back into position.

The earth system should be as extensive as possible for better efficiency; e.g. earth stake and a number earth radials, as long as possible around the garden to provide a counterpoise.

Link:

Visit www.g7klj.com - the website of 160 metre entusiast Steve G7KLJ

OTHER THINGS

Antennas for HF

There are dozens, if not hundreds, of antenna designs from which to choose. All have their own proponents. Some are genuinely good while others might be considered as nothing more than glorified dummy loads! The key thing for me was to choose the most effective an antenna that could fit within the constrains of my small back garden and also one that would not be too ugly.

I decided that wire antennas, made from PVC covered stranded wire, would be least objectionable on visual grounds. After all they look like glorified washing lines and almost everyone has a washing line**!**

Knots to use when fixing Wire Antennas

It's important to use the correct knot for the job. I find that the Bowline is very useful for fixing end, egg and dog-bone insulators to the ends of the wire and/or ropes. The Round Turn & Two Hitches, Anchor Bend and Buntline Hitch knots are very good for tying a rope to a pole or a mast. A Double Sheet Bend can join two pieces of rope together - even if they are of unequal size. 'Animated Knots' will show you how to do them: http://www.animatedknots.com

The antenna or antennas really are the key to an effective amateur radio station. The most expensive radio will be of little value unless it is used with the best possible and most effective antenna; so I had to set about finding the best antennas that I could accommodate for HF and VHF work.

The dilemma facing most radio amateurs is that antennas for HF are often large and difficult to accommodate in modern small back gardens. Additionally there may be objections on the grounds of visual impact. Some people do

not regard antennas as the beautiful creations that radio enthusiasts do!

Cables and Feeders

As I have learned by experience and from the tutorials I have studied as part of the licensing exam process, a very important consideration concerning the antenna system is the loss incurred in the cable that connects the radio to the antenna. A loss of 3dB sounds like a small amount when you say it quickly, but that equates to only HALF of your transmitter power reaching the aerial! We'd soon complain if our new 100 watt transceiver only produced 50 watts - so why stand the chance of losing this much power in the feed line?

Starting off as an M3 licensee I could only use 10dBw (10 watts) power at the antenna termination, so if I had a feeder with a loss of 3dB I would have to run the transmitter at 20 Watts to get 10 watts to the aerial!

Coaxial Cables

For HF using a single band resonant antenna, a dipole for example, Mini 8 or even RG58 is probably fine since the SWR should be between 1:1 and 2:1. However if one was to consider using the antenna on non resonant frequencies the VSWR will be higher, maybe very much higher, and the consequential losses in coaxial cable will be greatly magnified and power losses very significant. I did not want to run such an inefficient station.

For this reason I chose to use low loss RG213 coaxial cable for my Inverted L since I may need to use it on bands other than the 40 metre and 80 metres that it is intended for and where the SWR may be 4:1 or 5:1. RG213 will help keep feedline losses to a minimum. No lossy RG58 on Mini8 for me! Westflex 103 would be even better, of course.

For VHF and UHF I now consider Westflex103 as the minimum standard of cable to use, it's half the loss of even RG213. Losses at VHF are much higher than HF and at UHF they are even higher, so Westflex 103 helps preserve as much of that precious transmitter power as possible.

See more about Coaxial Cable Losses here >

Balanced Feeders = Low Noise

It's difficult to feed a centre fed wire dipole with RG213 or Westflex 103, both cables are really too thick and heavy. RG58 or Mini 8 are lighter and therefore more suitable for suspended wire dipoles, but to match the unbalanced coaxial cable to the balanced dipole would need a 1:1 'choke balun' at its centre, as I have learned. However, as mentioned above, when attempting to use the dipole at non-resonant frequencies the VSWR will be higher and the losses in the coaxial cable will be very much larger too, and hence much less of the precious transmitter power will be actually radiated by the antenna. Not an ideal situation

I have learned that the only really sensible way to feed dipole type antennas, which are 'balanced', is to use a balanced feeder such as 300 ohm ribbon cable, 450 ohm ladder line or the best option, it seems, might be 75 ohm Twin Feeder. All such twin feeders are extremely low loss, much much lower than any coaxial cable, so low that it could almost be considered lossless by comparison. Of course nothing is lossless, but twin feeder is as near as you'll get, so that's how I will feed my dipoles from now on! See the note on Doublet antennas below.

Tony Nailer of Spectrum Communications notes that: "75 ohm twin feeder is lower loss than coax. It allows the aerial to be properly balanced and the very close spacing of the wires prevents pickup or radiation from the feeder. It does not need to be spaced off, unlike ribbon feeder. Use of twin feeder makes this aerial much lower noise than one fed with coax. Also importantly it generates less TVI !! Note that the [trapped dipole] aerial is generally 72 ohms, and will need to be used with an ATU with transistorised rigs which are unforgiving about SWR mismatches."

Spectrum Communications are now supplying a new design of top quality, very low loss, twin feeder. It is rated at 2kW at 100 ohms. It can be supplied by 100 metre reel or by the meter, or in various lengths with the ends expertly terminated and made off. I can confirm the superior quality of this product and its low noise properties.

Spectrum Communications also supply a very high quality, well made 1:1 Balun that is perfect for connecting the twin feeder to the unbalanced input of an A.T.U. of transceiver.

Doublet or Dipole (Horizontal or Sloper)

I have also experimented with a second HF antenna - the 'doublet' style antenna. I fed this with low loss twin feeder and cut it for the lowest frequency of operation, in my case 20 metres (14 MHz).

Some initial experiments have shown that it is very effective on 20 metres, better than my Inverted L - which is designed essentially for 80m and 40m.

In theory a doublet antenna, when fed by twin feeder (NOT coaxial cable) and matched at the transmitter end via a

1:1 balun and an ATU (or to use a more correct term, Antenna Matching Unit) at the transceiver should be able to work on all bands with a higher frequency than the band that it is cut for.

On other bands such as 17m (18 MHz), 15m (21 MHz), 12m (24 MHz) and 10m 28 MHz) the doublet showed generally lower VSWR than the Inverted L ..... however (and here is a nice lesson) it is actually not quite as effective as the Inverted L! I think that size may matter here - the overall length of the Inverted L is much longer.

This short 14 MHz doublet is only about 10 metres in total length and was suspended at about 25 feet high at one end from the same fibreglass pole fixed at the apex of the roof and taken down to another 16 foot high wooden pole installed on the other side of the back garden in somewhat of a 'sloper' style.

Trapped Horizontal Dipole or Vertical Antenna for 20m / 10m

I also experimented with a trapped wire dipole cut to be resonant for 20 metres and 10 metres, again fed with twin feeder and matched at the radio end via a 1:1 balun and the ATU (AMU !).

I may also try an antenna for 20m / 15m and 10m in a Vertical 'ground plane' arrangement which should give a lower angle of radiation than a horizontal dipole - therefore better for longer distance DX.

At the moment I am using the 20m / 10m trapped dipole in a rather unorthodox arrangement. I have installed a fibreglass fishing pole, mounted vertically on a stake on one side of the garden. Most of the wire dipole is fixed to the vertical pole, but being as the dipole is somewhat longer than 7 metres, a portion of the wire runs away from the pole horizontally along a fence panel about 1.5 meters above ground level. It's vaguely L shaped, but mostly vertical which should help with the angle of radiation. It seems to work very well indeed - I like the mostly vertical idea.
The antenna can be seen on this page >

Other Dipoles:

Spectrum Communications can supply a full size W3DZZ style antenna with a 7MHz trap for use on 40m and 80m and usable on 20m, 15m and 10m. A half size version with a 14 MHz trap for use on 40m and 20 metres, plus 15m and 10m is also available. As a special order an even shorter version using a 28 MHz trap is available for 20 metres and 10 metres. http://www.spectrumcomms.co.uk/G2DYM.htm Al versions designed to be used with balanced line feeder - lince they are balanced aerials - for low noise and lowest loss.

PDF Document - The W3DZZ Antenna -
http://www.users.icscotland.net/~len.paget/GM0ONX%20trap%20dipole.pdf (But rather than using coaxial cable with a 'choke balun' at the centre of the dipole, try using twin feeder with the Choke Balun at the radio end for less power loss!)

Links

Enamelled copper wire supply: http://www.esr.co.uk/electronics/cable-copper.htm

Loading coil calculators: http://www.k7mem.com/Electronic_Notebook/antennas/shortant.html

Ring Core Calculator: http://www.dl5swb.de/html/mini_ring_core_calculator.htm

Vertical Antenna For 50 MHz, 144 MHz and 430 MHz

Watson W-2000 on Telescopic Mast at the lowest position
more on this page

OTHER ANTENNAS

Our good friend in Australia Felix Scerri, VK4FUQ, uses Inverted V antennas but also highly recommends the Quad Loop style antenna for HF work. These are well worth investigating, and you can read more here: Antennas 3 see the antennas at the MØMTJ QTH here with many more antenna ideas on Antennas 4 and the Links Page here and here

Antennas 1 | Antennas 3 | Antennas 4 | Antennas 5 | Antennas 6 | Antennas 7

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